3 Branches of the Same Tree: Art, Science and Education

A teacher's Resource Pack for Key Stage 2 students

Focusing on curriculum topics: Forces & Magnets, Light and Sound

Part 3 of 4: Light

Alongside the exhibition at Pump House Gallery
23 April - 31 May 2015

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THE BRIGHTER BOROUGH Wandsworth

Introduction

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3 Branches of the Same Tree brings together theories and concepts of science, art and education. The project has formed through the collaboration between three artists, three scientists and teachers from six Wandsworth-based primary schools. The aim was to create an exhibition of new work developed from research into Key Stage 2 curriculum areas of Light, Forces & Magnets and Sound. The exhibition aims to explore how art can be used as an access point into traditionally challenging areas, the outcomes of which are complemented by this Teacher's Resource Pack.

Beginning in September 2014, the project has involved each artist engaging in scientific research through close collaboration with a scientist and teachers from two Wandsworth primary schools. The process began with six working group sessions exploring the curriculum areas, where activities developed and ideas were tested out with students. Initially looking at the ways science can be taught, from January to March the artists' work developed as they applied their practice to question how the lenses of science and art affect our perception of the world.

This Resource Pack has been created alongside the artists' work as it has developed. Working with Primary Science Consultant Naomi Hiscock, Art Consultant John Tucker and Art Teacher Hazel Hardy, the activities in this Pack aim to locate the meeting point between art and science. Designed for and by Science teachers, it was vital that the art explored developed the students' scientific knowledge. As ideas were tested and checked over, the cross-overs between the practices of both scientists and artists became increasingly visible. The 18 activities bring together artists from around the world, linking those from the past and today and the work developed by the project artists. The activities not only meet the curriculum requirements but will inspire curiosity, learning and understanding of both art and science.

Artistic duo Semiconductor Ruth Jarman and Joe Gerhardt worked alongside biophysicist Ben Robinson and teachers Jane Bettles from West Hill and Jenny Taylor and Peggy Cowdry from St Anne's primary schools to explore Light. The group explored photograms by artist Man Ray, created

Introduction

shadows of objects and paths of light as it reflects off surfaces. The critical moment that directed the outcome of the activities was the understanding that everything you see is reflected light. Early on in their research, Semiconductor came across a satellite called Landsat which captures images of the Earth and reflected light. Although this satellite programme has been running since 1972, in 2013 introduced a new band, 'Band 9', which captures a very small wavelength of light (1.38 microns) reflected from Cirrus clouds. Their work, *Band 9*, is an installation of light boxes presenting very high contrast, highly detailed images that capture the clouds from above and the reflected sunlight. Viewers are offered a different perspective of something familiar – the clouds from above.

Artist Alistair McClymont worked with neuroscientist Aleksandra Berditchevskaia and teachers Nancy Leeming and Nicolle Atkin from Griffin and Emma Pring and Kitty Russell from Falconbrook primary schools. Exploring students' understanding of how sound travels in vibrations, the group tested out ideas with elastic bands, specialist technology and mark making. As the project developed, McClymont's work focused on the connection we have with sound from scientific perspectives through to its use in contemporary music. The work *One should never mistake pattern... for meaning (Function Generator)* has been set up as an ongoing project involving experiments in collaboration with Berditchevskaia, and live performances with scratch DJ and producer Prime Cuts and artist and musician Tom Richards.

Working with scientist Max Boleininger and teachers Sarah Daniell and Pat Dickens from All Saints CE and Lara Ahmoye from Hotham Primary Schools, artist Lyndall Phelps has researched the possibilities of forces and magnets. As they tested out ideas with students, Phelps became fascinated by the apparent magic of magnets. Phelps has developed a series of installations for the exhibition that invite visitors to explore and interact with the effects magnets have on their surroundings. Using specialist materials, such as powerful magnets and liquid magnets, Phelps provides opportunities to test out and explore the mysteries of magnets.

This Resource Pack is available as an online downloadable PDF. The exhibition (23rd April – 31st May) is open for school groups to visit. For more information, please contact the gallery on 020 8871 7572 or email info@pumphousegallery.org.uk

We would like to thank all the teachers, artists and scientists involved in making this pack. We would like to thank Clare Thurman, Action Learning Facilitator, Davina Salmon, Education and Social Services Department, Wandsworth Borough Council and Ella Lewis-Williams, Project Assistant and Danielle Morris, Pump House Gallery Intern. We would also like to thank first4magnets and Beehive Coil Ltd for their support in providing materials for the exhibition.

This project has been funded by Mayor of London and London School of Excellence.

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LIGHT

LIGHT

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Where can we see shadows?

In this activity, children will explore shadows in the environment. Inspired by artist Ellis Gallagher, children will explore on a sunny day how the sun creates a shadow. Using chalk, they will draw round the shadows and if able to come back to this at another point to look at how the shadow moves.

Otherwise, working inside, children will look for shadows caused by artificial light sources.

National curriculum

SCIENCE OBJECTIVES
Pupils should be taught:

- To recognize that light from the sun can be dangerous, and that there are ways to protect their eyes.
- To recognize that shadows are formed when the light from a light source is blocked by a solid object.

ART AND DESIGN OBJECTIVES
Pupils should be taught:

- To record from first hand observation and to develop practical skills of drawing, using either chalk or pastels.
- To be able to communicate observations, ideas and feelings in reference to artist Ellis Gallagher, linking to key terms including line, shape and colour.

Activity 3.1 What to do

RESOURCES

On a sunny day

- ☐ Chalk
- ☐ Outdoor space
- ☐ Chalk pastels
- ☐ Larger objects such as stools, bicycle, wire bins etc, ideally objects with holes that will create interesting shadows

1. On a bright sunny day, take the children outside and ask them to spot shadows.

Ask the children:
a. What do they notice about the shadows?
b. What is making the shadow?

2. Ask the children how they think a shadow is created?

☞At this stage, the children might suggest that a shadow is produced by the light from a light source being blocked by an object.

Ask the children:
a. What is the light source?
b. What is blocking the light to produce each shadow?

3. Ask the children to select one of the shadows they have found. If possible, use the chalk to draw directly onto the outdoor floor, otherwise use large sheets of brown wrapping paper or A1 cartridge paper taped to the floor.

TEACHER'S NOTE:

Establish that the light source is the sun and talk to the children about the importance of not looking directly at the sun.

4. As the children trace the shadow using chalk, ask the children to think about both the positive shapes of the shadow and the negative shapes between the shadows.

5. Photograph their final drawing.

6. If possible, check back at various points to see how the shadow has moved – redraw if possible using a different coloured chalk.

Ask the children:
a. What has happened to the shadow?

Activity 3.1

RESOURCES

On a cloudy day

- ☐ Roll of brown wrapping paper / large sheets of paper
- ☐ Pencils
- ☐ Chalk pastels
- ☐ Everyday objects, such as plants, interesting objects with holes that will create interesting shadows
- ☐ Masking tape

What to do

1. If it is cloudy outside, use a collection of everyday objects and a torch to create shadows. Ask the children:
   (a) What do they notice about the shadows?
   (b) What is making the shadow?

2. Ask the children how they think a shadow is created.

☞At this stage, the children might suggest that a shadow is produced by the light from a light source being blocked by an object.
(a) What is the light source?
(b) What is blocking the light to produce each shadow?

3. Looking at the work by Ellis Gallagher from the Artist Resource sheet, ask the children to select one of the shadows they have found. Trace around the shadow using colour pencils/ chalk onto large sheets of brown wrapping paper or A1 cartridge paper taped to table.

4. As the children trace the shadow using chalk, ask the children to think about both the positive shapes of the shadow and the negative shapes between the shadows.

Assessment

SCIENCE

- ☐ Can the children spot shadows in the environment?
- ☐ Can they identify the light source and object casting the shadow?
- ☐ Can they describe the shadow? i.e. its shape and colour

ART AND DESIGN

- ☐ Can the children describe how they create shapes using both the negative and positive shapes created in from the shadows?
- ☐ Can the children identify which object has created which shape?
- ☐ Can they describe how the shape of the shadow is different from / the same as the shape of the object?

Activity 3.1 Artist Resources

ELLIS GALLAGHER

www.facebook.com/EllisGallagherNYC

Ellis Gallagher (born 1973, USA) is a street artist primarily known for his drawings in which he outlines shadows with chalk on the streets of New York. Gallagher will use chalk to trace the outlines of shadows cast by objects and street fixtures, in turn fixing temporary moments of changing light into solid images. Gallagher's works are also temporary as they will eventually be washed away by the rain, but some have lasted as long as a month. Gallagher is a former graffiti artist, but his current practice remains dependent on working very quickly before the light changes.

Ellis Gallagher 2009

How can we change shadows?

In this activity, children will explore how the size and shape of shadows can be changed. Inspired by artist Man Ray, children will draw around the shadows and combine them to create a piece of artwork.

National curriculum

SCIENCE OBJECTIVES
Pupils should be taught:

- To recognize that shadows are formed when the light from a light source is blocked by a solid object.
- To find patterns in the way that the size of shadows change.

ART AND DESIGN OBJECTIVES
Pupils should be taught:

- To record from first hand observation and to develop practical skills of drawing.
- To select, and use appropriately, the materials and techniques in order to create their own work and how to effectively transform their drawings into images inspired by artist Man Ray.
- To be able to communicate observations, ideas and feelings in reference to artist Man Ray linking to key terms including line, shape and tone.

Activity 3.2

RESOURCES

- ☐ Transparent plastic or Perspex sheets – A4 or larger
- ☐ Objects selected for their interesting shape, size, scale and transparency e.g. Plants, plastic 3D shapes, scissors, transparent rulers, feathers, paper clips, pegs, cutlery, nets
- ☐ Torches with one single bulb (very important)
- ☐ Darkened room
- ☐ A3 white and black paper
- ☐ Pencils
- ☐ Scissors
- ☐ Glue

What to do

1. Look at the work of Man Ray using the Artist Resource sheet or through the link below.

Discuss with the children how they think the images were made.

Man Ray, *Rayograph*, 1922. http://www.moma.org/collection/browse_results.php?criteria=O%3AAD%3AE%3A3716&page_number=12&template_id=1&sort_order=1

2. Introduce the activity, in which children will be cutting out the shapes created by shadows of everyday objects to make an image inspired by Man Ray's work.

3. Select a small object, and place it on the Perspex sheet. The Perspex sheet is there to hold the object so that it is easier to move it and change the shadow.

TEACHER'S NOTE:

At this stage the children won't know what has made the different tones of grey in the image. The work by Man Ray are made using a technique called photograms.

This is a photographic image made without a camera by placing objects directly onto the surface of a light-sensitive photographic paper and then exposing it to light. The usual result is a negative shadow image that shows variations in tone that depends upon the transparency of the objects used.

Areas of the paper that have received no light appear white; those exposed through transparent or semi-transparent objects appear grey.

Activity 3.2

What to do

4 Show the children how to create a shadow on the table by holding the light source above the Perspex. Ask the children to explore how the shadow can be changed.

Ask them to explore:
(a) Do all the objects give shadows the same colour?
(b) How can they change the shadow created on the table by the object?
(c) Can they change the shape of the shadow?
(d) Can they change the size of the shadow?

5 Consolidate what they have learnt from the exploration. Explicitly teach them the words – transparent, translucent and opaque – and explain that you will be listening to hear them use these words when they continue with the activity. Highlight the fact that the shape and size of the shadow can be changed in a number of ways.

6 Provide a range of paper from white to black to put on the table to see how this affects the shadow. Ask them to explore:
(a) How do shadows change on white and black paper?

7 Using the art materials, the group can create images by tracing the shadows onto the paper to capture the shapes in the style of the artist.

Can they create:
(a) Three shadows of the same shape but different sizes?
(b) Three different shaped shadows from one object?

8 Cut these shapes out using white paper and create an image using these cut-outs onto black paper.

9 Ask the children to swap their resources with another group. Can they produce the same shadows?

10 Compare their work to the work on Man Ray. Referring back to the work they have made, ask the children:

(a) Can they describe how the images have been made?
(b) Can they identify why there are different tones in the work?

Assessment

SCIENCE

- ☐ Which key words do the children use whilst carrying out the activity? – Shadow, light source, transparent, translucent, opaque
- ☐ Which children can demonstrate how to change the size of the shadow?
- ☐ Which children can correctly predict whether a change will make the shadow bigger or smaller?
- ☐ Which children link the darkness of the shadow to the opaqueness of the material?

ART AND DESIGN

- ☐ Can the children identify which object has created which shape?
- ☐ Can they describe how the shape of the shadow is different from the shape of the object?
- ☐ Can the children describe why there are different tones in Man Ray's photographs?

Activity 3.2 Artist Resources

MAN RAY

Man Ray (1890-1976, USA) was a painter, filmmaker and photographer involved with the Surrealism and Dada art movements. He has become most celebrated for his work in photography and photograms, which he called the 'rayograph'.

His photograms were usually made up of commonplace objects composed in an apparently casual way. This way of transforming ordinary objects into mysterious images was appreciated by other artists involved with Surrealism – a movement dedicated to bringing the world of dreams and the subconcious into real life.

A photogram is a method of producing a photographic image without a camera by placing objects onto photo-sensitive paper and exposing it to light. The resulting image is usually a negative shadow that shows variations in tone depending on the transparency of the objects used. Areas of the paper that have not been reached by light appear white – i.e. the object was solid; areas of paper exposed through transparent or semi-transparent objects appear grey.

Sources:
http://www.moma.org/collection/artist.php?artist_id=3716

Man Ray, *Rayography visage profile & egg; Rayography Bulb.* © Man Ray Trust/ADAGP, Paris and DACS, London 2015.

How can we combine shadows to create a different image?

In this activity children will continue to explore how the size and shape of a shadow can be changed. Inspired by artists The Silhouettes, Rashad Alakbarov and Fred Eerdekens, the children will use their own bodies or other objects to cast the shadows that combine to produce a different image.

National curriculum

SCIENCE OBJECTIVES
Pupils should be taught:

- To recognise that shadows are formed when the light from a light source is blocked by a solid object.
- To find patterns in the way that the size of shadows change.

ART AND DESIGN OBJECTIVES
Pupils should be taught:

- To work in groups to experiment with everyday objects to create shadow.
- To compare ideas, methods and approaches in creating a sculptural pieces, with reference to artist Rashad Alakbarov, Attraction and Fred Eerdeken.
- Depending on scale, to experiment with the way the distance of the objects, their form, and the angle of the light source affects the shape of their shadow, using the key words form and shape.

Activity 3.3 What to do

OPTION 1

Inspired by shadow artists, for example The Silhouettes, children create shadow shapes using their own bodies - this will need a large hall area.

OPTION 2

Inspired by the work of artist Rashad Alakbarov, pupils create shadow shapes using found objects – this can be done in a classroom.

OPTION 3

Inspired by the work of artist Fred Eerdeken, children explore simple continuous line drawing activities to create wire work of their initials or name that will only be seen in the shadow – this can be done in the classroom.

RESOURCES

Option 1

- ☐ Artist images
- ☐ Large lights
- ☐ Flat wall or a display board lined with white paper/a sheet
- ☐ Darkened room
- ☐ Digital Cameras (E.g. Canon SureShot)

1. Show the children the work of artist Tim Noble and Sue Webster and The Silhouettes' performance, asking the children to consider how they think the work has been made?

https://www.youtube.com/watch?v=O7VeO0kja_M&feature=youtu.be
The Silhouettes, THE JOURNEY OF LOVE (HOMECOMING))

http://www.timnobleandsuewebster.com/self_imposed_misery_2010.html
(Tim Noble and Sue Webster, *SELF IMPOSED MISERY,* 2010)

Activity 3.3

What to do

TEACHER'S NOTE:

Please be aware that Noble and Webster's website contains content not suitable for children. The links provided will take you directly to the image in the Artists Resource sheet only.

http://www.timnobleandsuewebster.com/self_imposed_misery_2010.html

2 Introduce the activity, in which children will be using their bodies to create shapes.

3 Allocate each group a space to work in and a strong light.

Ask them first to produce a series of shadows that you specify

☞ A shadow of an adult and child walking hand in hand.
☞ A letter of the alphabet
☞ A number

4 Recap back over Activity 2, where students learnt about how a shadow is made, and how the shape of a shadow changes depending on where it is in relation to the light source.

5 Ask the children to draw their own ideas for a basic shadow image.

Ask them to think about:
(a) How they will create the shadow using people?
(b) How many people will be involved?
(c) Where will they need to stand?
(d) What positions will they be in?

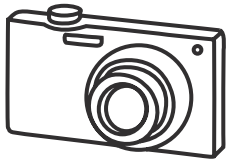
6 Ask them to create the shadow art and record in three photographs – one of the shadow art on the wall, one showing the shadow art and the people creating it, one showing just the people creating it but not the shadow.

7 Compare their work with the work of artists Tim Noble and Sue Webster and The Silhouettes, asking each group to describe how they made their shadow image, and use this to discuss how the artists made their work.

EXTENSION ACTIVITY:

8 Inspired by The Silhouettes, can they put a few shadows together to form a sequence?

☞ Capture on camera.



Activity 3.3 What to do

RESOURCES

Option 2

- ☐ Artist images, Resource Sheet.
- ☐ Torches
- ☐ Found objects
- ☐ Blue tac to hold objects down
- ☐ Cardboard (which will need to be large enough to project the shadow onto)
- ☐ Darkened room
- ☐ Digital Cameras that will record still images (E.g. Canon SureShot)

1. Look at the work of artist Rashad Alakbarov and ask the children how they think this work was made?

http://www.demilked.com/shadow-paintings-rashad-alakbarov/

2. Working in groups of three, provide each group with access to a range of recycled materials for modelling and a table to work on. Keep in mind that the work will cast a shadow onto the cardboard, so it will need to fit.

3. Ask the children to try and create a skyline – this could be a real skyline or an imagined scene – using the shadows from the junk modelling.

4. Ensure the children remember that they can change the size of an object by moving it.

Ask the children to consider:

a. How does the shape of the shadow change when they move the objects?

5. When they have completed the artwork: place the cardboard behind the work; switch the main lights off and use a strong torch to create the cityscape shadow onto the cardboard.

6. Evaluate how successful the recreation of the cityscape is. Use a camera to record the cityscape.

7. Compare their work with the work of artist Rashad Alakbarov, asking each group to describe how they made their shadow image, and use this to discuss how Alakbarov made his work.

EXTENSION ACTIVITY:

8. Following on from this, the children could explore how moving the light source like the sun changes the shadows.

Activity 3.3 What to do

RESOURCES

Option 3

- ☐ Artist Images
- ☐ Light source
- ☐ Flat wall, white board
- ☐ Digital Cameras (E.g. Canon SureShot)
- ☐ Pipe cleaners or soft modelling wire 0.5mm
- ☐ Scissors
- ☐ Blue tack/plasticine to hold the wire sculpture or a crocodile clip photograph holder

1 Show the children the examples of Fred Eerdeken's work and continuous line drawing art work. Discuss what the children can see in Eerdeken's work?

Fred Eerdeken, *Could suggest something...*, 1999. http://www.fred-eerdekens.be/?page_id=19

2 Introduce the activity by asking the children to create a continuous line drawing of their name by keeping their pencils on the page. Repeat in their sketchbooks, filling a page.

3 Tell the children that they will be creating the shapes of the letters of their name using wire sculpture. Demonstrate bending and how to cut safely with scissors.

4 First allow the children time to handle the wire and get familiar with bending it into different shapes e.g. their initials/name, sticking any samples into their sketchbook with selotape.

5 Provide them with a torch and ask them to use this to try and create a shadow of their name using the wire. Crocodile clips or blue tac can be used to hold the work in place.

6 Refer back to the shadow art and ask them to think about:

a How do they think the artist has created this work?

b How is the shape of the wire work different from the shadow?

7 Now encourage the children to adapt the wire modelling so that the line of the letters is not obvious from the wire structure but only becomes clear when looking at the shadow.

For example, if they made the shape of one of the wire letters smaller, what would they then need to do to keep the shadow of the letters all the same size?

Activity 3.3 Assessment

(a) How illegible can they make the wire work whilst keeping the shadow readable?

8 Ask the children to discuss their work with the class, and how they will display their work, taking into account the shape of the shadow?

SCIENCE

- ☐ Which key words do the children use whilst carrying out the activity?
  – Shadow, light source
- ☐ Which children can demonstrate how to change the size of the shadow?
- ☐ Which children can correctly predict whether a change will make the shadow bigger or smaller?

ART AND DESIGN

- ☐ Can the children describe how the artists made their work?
- ☐ Can they describe how the shape of the shadow is different from the shape of the object?
- ☐ Can the children describe the most important qualities of the available materials for making them effective to use? How have they used the materials to create the best shadows? What other materials could they use?

Activity 3.3 Artist Resources

OPTION 1

☞ Students to create shadows shapes using their own bodies – this will need a large hall area.

The Silhouettes is a dance group from Colorado, USA best known for performing on the television competition America's Got Talent in 2011. Using light, colour, video, photographs, dance, acting and mime, the act is performed by 42 Silhouettes members, ranging from 4–18 years old.

http://thesilhouettes.com/

Activity 3.3 Artist Resources

OPTION 1

☞ Students to create shadows shapes using their own bodies – this will need a large hall area.

Tim Noble and Sue Webster (born 1966 and 1967, UK) are an artist duo who take ordinary things such as rubbish to create assemblages that only become an identifiable form through their projected shadows when lit.

The duo are interested in the process of transformation, from discarded waste to a recognizable image. Throughout their careers they have played with the idea of how humans evaluate abstract forms and define them with meaning.

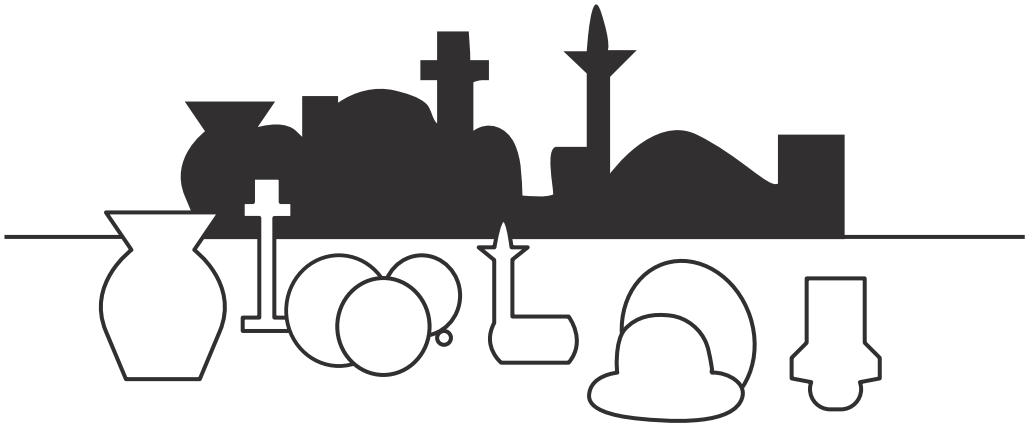
Tim Noble and Sue Webster, S*elf Imposed Misery*. 2010, 1 wooden stepladder, discarded wood, light projector. © Tim Noble and Sue Webster. All Rights Reserved, DACS 2015

OPTION 2

☞ Shadow artwork modelling with recycled materials.

Rashad Alakbarov (born 1979, Azerbaijan) is an artist working in painting, sculpture, theatre decorations, video art and architectural design, but with a particular interest in large-scale installations. In these installations, Alakbarov arranges found and recycled objects and materials in a seemingly random configuration. However, when lit by positioned lamps, these objects cast shadows on the wall to bring a theme or story to life.

www.rashadalakbarov.com



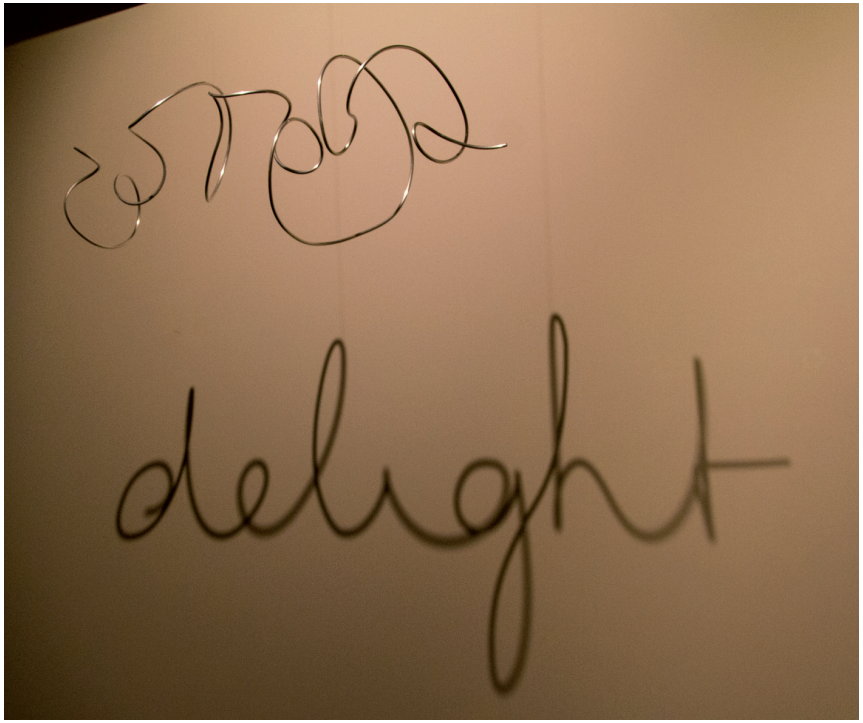
OPTION 3

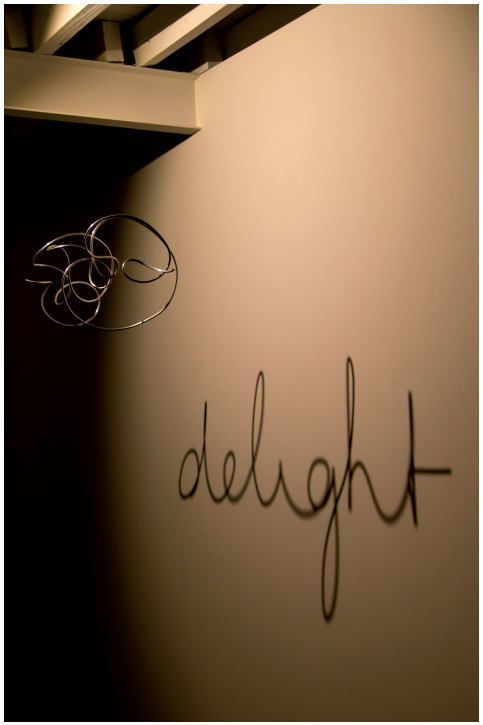
☞ Shadow artwork modelling with wire.

Fred Eerdekens (born 1951, Belgium) is an artist who, like Noble and Webster, is interested in playing with and transforming the meanings of things that we think we are familiar with.

Eerdekens manipulates wire into certain shapes that cast a very specific shape when lit. The twisted wire itself does not seem to have any recognisable meaning, and it is suprising that it can cast such legible 'shadow-images' that mean something to us through language.

www.fred-eerdekens.be





Fred Eerdekens *delight*, 2015. 33 x 86 x 31,5cm

How does the amount of light affect what we see?

In this activity children will discover that we need light in order to see objects. Inspired by the history of peephole boxes, children will create a miniature scene inside a box and explore how the amount of light affects what we can see. They will explore this by varying the amount of light entering the box and looking at the objects inside.

National curriculum

SCIENCE OBJECTIVES
Pupils should be taught:

- ☐ Recognise that they need light in order to see things, and that dark is the absence of light.

ART AND DESIGN OBJECTIVES
Pupils should be taught:

- ☐ How the level of light affects how we see colours
- ☐ When creating a scene inside a box, explore composition and how to arrange objects.
- ☐ Develop technical skills, in particular how to use cardboard and masking tape to construct 3D work.

Activity 3.4

RESOURCES

- ☐ Cardboard boxes e.g. shoe box, computer paper boxes or crisp boxes
- ☐ Scissors
- ☐ Card
- ☐ Tape
- ☐ Postcard images
- ☐ Coloured/white/black card
- ☐ Small everyday objects

What to do

1. Before the lesson, create a peephole in the short side of each box using a dowel stick. Make a number of further holes all over the boxes and cover them with flaps made of black paper that can be raised to let light into the box.

2. In the class, introduce the activity, in which children will create a scene inside a box and explore how light is needed to see this scene.

3. Start by using white card and ask the children to cut shapes out of card. The children will need to fold a 1cm edge at the bottom of their shape so that the card stands up inside the box. One child chooses some shapes, puts them in the box and places the lid on firmly. The other members of the group take it in turns to look inside the box.

What can they see?

TEACHER'S NOTE:

They should hopefully see nothing (blackness). Ensure that the children understand that they cannot see anything as there is no light in the box. Without light we cannot see. Complete darkness is when there is no light. Point out that at night in their bedrooms they can probably still see. This is because their rooms are not completely dark, as there is usually a little light coming from somewhere.

Activity 3.4 Assessment

4 Allow time for the children to set up their own experiment raising and lowering different flaps on the box to let light into different parts of the box.

5 Ask the children to think about creating a scene inside their box, using images on postcards and coloured paper to create a landscape.

6 When the children are using different coloured paper, ask them to consider:
a Which colours are easier to see?
b Which colours are more difficult to see?
c Can you see a pattern?
d Can you use this to predict whether you will see an object made of a different colour?

7 When the children have tested this out, lay the box flat again and ask the children to use postcard images and card to create a scene inside the box.

SCIENCE

- ☐ Which children can talk about how we see differently in different amounts of light?
- ☐ Which children can talk about the difference between complete darkness and what we generally refer to as darkness?
- ☐ Which children were able to carry out an investigation to explore how easy it is to see different colours?
- ☐ Which children were able to use this knowledge to make a prediction about whether they would see an object made of a different colour?

ART AND DESIGN

- ☐ How well did the students cut out shapes and arrange them in the box?
- ☐ Can the children describe the composition of their miniature scene and how the light sources affecting their decision for this composition?
- ☐ Can the children describe the importance of the size and shape of the card?
- ☐ Can the children describe what they could have done better? (discuss with others)
- ☐ Can the children describe other artwork or work they know that is arranged in boxes?

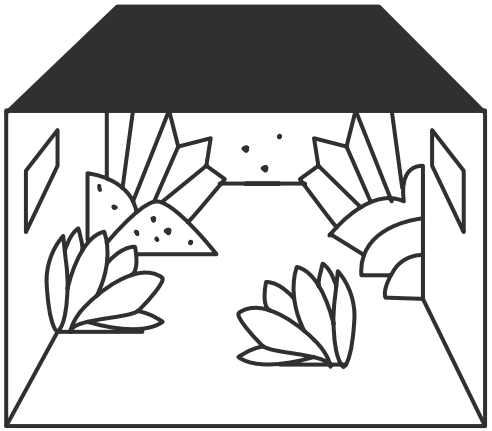
THE PEEPSHOW

The peepshow was a shortlived phenomenon in Holland in the seventeenth century and is a prime example of Dutch artists' fascination with optical devices. Only six of these boxes, all of which simulate a domestic or church interior, survive.

A peepshow combines both real and suggested space.The use of a peephole places certain constraints on the viewer which are essential for the success of the illusion.

The perspective of the scene is constructed so that when viewed through a peephole an illusion of receding space with apparently free-standing figures and furniture is seen, although there are no actual models standing in the box.

http://www.nationalgallery.org.uk/paintings/samuel-van-hoogstraten-a-peepshow-with-views-of-the-interior-of-a-dutch-house



Introduction 3.5

How does the transparency of an object affect the shadow it casts?

In this activity children will discover how a shadow gets darker as the material of the object casting the shadow becomes more opaque. Inspired by exhibiting artists Semiconductor's photographs of light reflecting off clouds, the children will create cloud-like forms, by layering a variety of different materials. They will also measure the amount of light that passes through different layers of the paper, and link this to the darkness of the shadow.

National curriculum

SCIENCE OBJECTIVES
Pupils should be taught:

- To recognise that shadows are formed when the light from a light source is blocked by a solid object.
- To describe the simple physical properties of a variety of everyday materials (Year 1).
- To compare and group together everyday materials on the basis of their properties, including their transparency (Year 5).

ART AND DESIGN OBJECTIVES
Pupils should be taught:

- To experiment with different materials and tools - investigating, recording and developing ideas before selecting the most suitable materials to create an overcast sky.
- To adapt their work after discussing, comparing, and learning from their own and other's work;
- To learn more about visual and tactile elements, with particular focus on composition, shape and tone.

Activity 3.5

RESOURCES

- ☐ Opaque paper e.g. greaseproof paper, sheets of packing material, wadding, tracing paper
- ☐ Different adhesives, including PVA, magic tape, double sided tape, selotape
- ☐ Strong torches
- ☐ Acetate sheets
- ☐ Boxes from Activity 4
- ☐ Datalogger or ipads with an app to measure light (Luxmeter is a free app that will do this)

What to do

1. Referring back to the Activity 1, ask the children why they can only see shadows on a sunny day.

☞ Link this knowledge back to the way clouds create a shadow on the Earth by stopping the light from passing through.

2. Introduce the children to the activity, in which they will be using materials of varying transparencies to create cloud-like structures to be attached to the top of their scene inside the box from Activity 4.

3. Starting with tracing/greaseproof paper, ask the children to explore how using different numbers of layers of paper affects the shadow. They should discover that, as the number of layers is increased, the shadow gets increasingly darker. This is because more of the light is being blocked by the paper.

4. Next ask the children to explore how different adhesives affect the amount of light that passes through.

5. If children made a scene inside a box for Activity 4, after testing out these ideas, ask the children to open up the box and cut out a piece of tracing paper that will go over the top of the box.

☞ Make sure the children allow some room around the edge for this to be neatly stuck down.

6. Ask the children to imagine that they are using the translucent materials to create a cloud and make their scene inside a box look like a storm is about to happen. Ask them to imagine what the clouds look like before a storm?

7. Ask the children to begin to stick on layers of the different translucent materials onto the tracing paper to build up cloud like patterns across the paper.

Activity 3.5 What to do

TEACHER'S NOTE:

The key is to try and create increasing darkness by building up the layers.

Ask the children:

(a) To test out their cloud patterns and the amount of light the layers are let through by placing their tracing paper sheet over the box.

(b) Make sure the children are taking note of how many layers they have used, the materials and what adhesive they used.

8 When the area is sufficiently covered, the children can then use a datalogger or ipad with an app that measures the amount of light to work out how much light passes through the layers of paper.

9 Ask them to describe how they created their scene, including details of how many layers they used, what materials and adhesive, and how much light passed through the different numbers of layers.

Ask the children:

(a) Did they see a pattern? (As the number of layers increases, the light passing through decreases).

(b) Can they present the results as a graph?

(c) Can they use this evidence to explain why the shadow gets darker as the number of layers increases?

SCIENCE

- ☐ Which children can record their results systematically in a table?
- ☐ Which children can present their results in a graph?
- ☐ Which children are able to use their results to explain how the darkness of the shadow is dependent on the transparency of the object causing the shadow i.e. the amount of light that passes through it?

ART AND DESIGN

- ☐ Can the children describe how the level of illumination in their scene changed the feel and mood of their work?
- ☐ Can the children describe how they made their work, and what materials were best to use?

SEMICONDUCTOR

www.semiconductorfilms.com/art

Semiconductor is UK artist duo Ruth Jarman and Joe Gerhardt. In their art works they explore the material nature of our world and how we experience it through the lens of science and technology, questioning how they mediate our experiences.

For the exhibition, their work *Band 9* is an installation that considers nature within the framework of science. Semiconductor have worked alongside biophysicist Ben Robinson and teachers from West Hill and St Anne's primary schools.

Informed by research into reflected light, *Band 9* is an installation of light boxes showing data collected by satellites looking at Cirrus clouds. Captured from space by a remote sensing satellite orbiting the Earth, the images offer new ways of seeing the familiar.

Semiconductor, *Band 9.* 2015 © Eion Carey

How does light reflect off surfaces?

In this activity, children will look at how light reflects off different surfaces. Inspired by exhibiting artists Semiconductor's images of light reflected off clouds and artist László Moholy-Nagy's sculptural work, children will create a mobile using reflective and non reflective surfaces. Looking at the how light reflects off the different surfaces, and the patterns these create across a wall, children will explore how Semiconductor's images have been created.

National curriculum

SCIENCE OBJECTIVES
Pupils should be taught:

- To notice that light is reflected from surfaces.

ART AND DESIGN OBJECTIVES
Pupils should be taught:

- To develop their techniques, including their control and their use of everyday materials to create a mobile.
- To experiment with a variety of materials in creating the mobile, and to record how the different materials change the reflective patterns that are created.
- To communicate their observations, ideas and feelings about their designs.
- To improve their knowledge of great artists in history, including artists Semiconductor and Laszlo Moholy-Nagy.

Activity 3.6 What to do

RESOURCES

- ☐ Torches or LED finger lights
- ☐ Range of reflective materials and objects e.g. small mirrors (flat and curved), CDs, tin foil, sequins, metal containers e.g. mince pie cases
- ☐ Other sheet materials e.g. paper, card, transparent plastic
- ☐ String
- ☐ Coat hanger
- ☐ Scissors
- ☐ Sellotape
- ☐ Capacity to create a darkened room
- ☐ Camera

1 Show the children the pieces of art work by the artist László Moholy-Nagy, using the link below.

Ask them to discuss this and to explore how the shadows are made.

Can the children identify which are shadows and which reflections?

http://bauhaus-online.de/en/atlas/werke/light-space-modulator (László Moholy-Nagy, *Light-Space Modulator*, 1922-1930)

2 Provide each group with a torch and a range of reflective objects and every day materials. Allow time for the children to explore the use of these reflective objects to bounce light around the room.

3 Ask the children to select a range of reflective objects and every day materials to attach to a coat hanger / wooden rod to create a mobile inspired by László Moholy-Nagy.

4 Hold the mobile in front of a strong light. Encourage the children to:

a Look for shadows around the room and also the light reflected off the mobile.

b Talk about which parts of the mobile are causing each shadow and reflection and how they know.

5 Look at Semiconductor's images in the Artist Resource sheet.

Ask the children how they think these images have been made and to then try and create a photograph of the reflected light

For this, the children might need to:

a Add in more reflective surfaces to their mobile.

b Explore how the light reflects off the materials and where it hits the wall.

Activity 3.6 Assessment

SCIENCE

- ☐ Which key words do the children use whilst carrying out the activity? – Reflective, material, reflected light, mirror
- ☐ Which children can distinguish between reflective and non-reflective materials?
- ☐ Which children can spot reflected light?
- ☐ Which children can work out the object causing a particular reflection?

ART AND DESIGN

- ☐ Can the children describe which materials create the best/most interesting reflected images? Using key words of pattern, shape, tone.
- ☐ Can the children describe what they needed to do to create the most interesting photograph?

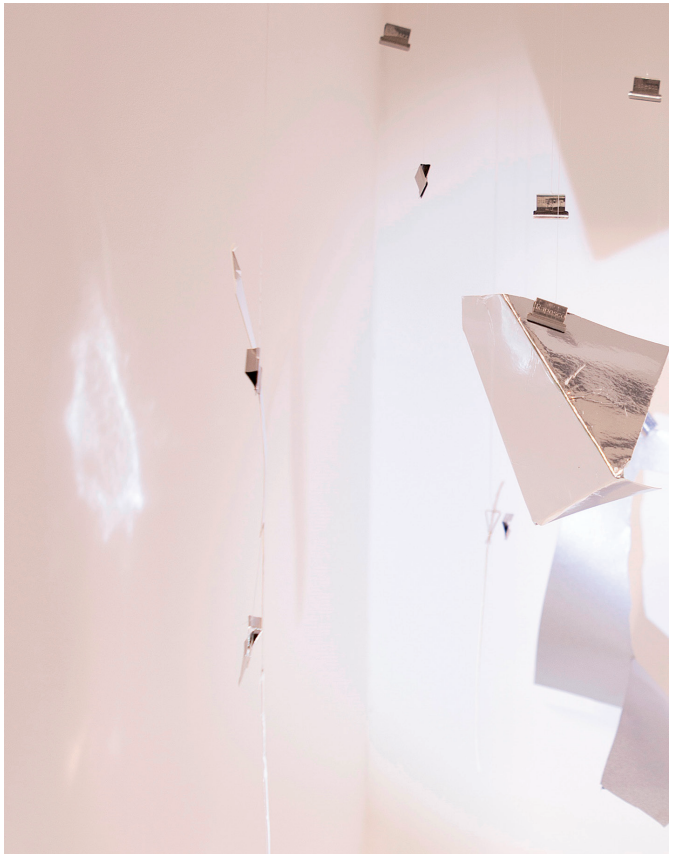
LÁSZLÓ MOHOLY-NAGY

László Moholy-Nagy (1895-1946) was a Hungarian artist working experimentally across painting, sculpture, photography, design and film. His work was influenced by his interest in the relationships between space, time and light and the interaction of man with these forces.

Moholy-Nagy's *Light-Space Modulator* (1922-1930) was a mechanical work made up of three moving metal and glass structures arranged on a rotating disc. Moholy-Nagy designed the work so he could study the movement of light and shadow to help formulate his theories of the moving image.

Flickering coloured and white lights placed in different positions illuminated the discs attached to the metallic 'machine' which then cast reflections around the room and projected moving shadows onto the walls. In 1930, the work became the centre of Moholy-Nagy's experimental short film *Light Play: Black-White-Grey*, where the moving light and shadows of the sculpture created a complex, spatial experience.

Sources:
http://bauhaus-online.de/en/atlas/werke/light-space-modulator



Refllected light experiment. 2015 © Eion Carey

SEMICONDUCTOR

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